

WHAT IS CLAIMED IS:

1. A nitride semiconductor device comprising:

a semiconductor layer;

5 a first electrode for establishing an ohmic contact disposed on the semiconductor layer, the first electrode including an upper layer and a lower layer and being subjected to heat treatment; and

10 a second electrode formed on the first electrode, the second electrode having a different shape from a shape of the first electrode, the second electrode further including an upper layer and a lower layer,

15 wherein the upper layer of the first electrode and the lower layer of the second electrode comprise an element of the platinum group and form a joint region joining the first electrode to the second electrode.

2. A nitride semiconductor device according to claim 1, wherein the lower layer of the first electrode comprises a material which is alloyable by heat treatment.

20 25 3. A nitride semiconductor device according to claim 1, wherein the upper layer of the first electrode comprises an elemental metal of the platinum group or an alloyed material essentially composed of homologous elements in the platinum group.

4. A nitride semiconductor device according to claim 1,  
wherein the lower layer of the second electrode comprises an  
elemental metal of the platinum group or an alloy including at  
5 least one of the platinum group metals.

5. A nitride semiconductor device according to claim 1,  
wherein the upper layer of the first electrode comprises Pt.

10 6. A nitride semiconductor device according to claim 1,  
wherein the lower layer of the second electrode comprises Pt.

7. A nitride semiconductor device according to claim 1,  
wherein the surface of the semiconductor layer on which the first  
15 electrode is formed comprises an electrode formation region and  
an insulating layer formation region and the second electrode  
overlies the electrode formation region and the insulation layer  
formation region.

20 8. A nitride semiconductor device according to claim 7,  
wherein the insulating layer formation region comprises a  
plurality of areas arranged on both sides of the electrode  
formation region in a stripe, or a plurality of areas separated  
by the electrode formation region.

9. A nitride semiconductor device according to claim 1,  
wherein the semiconductor layer has a ridge and the first  
electrode is disposed on the upper surface of the ridge so that  
the nitride semiconductor device functions as a laser device.

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10. A nitride semiconductor device according to claim 9,  
further comprising a first insulating layer extending from the  
side surfaces of the ridge to the upper surface of the  
semiconductor layer and a second insulating layer extending from  
10 the upper surface of the first insulating layer to the side  
surfaces of the semiconductor layer, the second insulating layer  
being separate from the first electrode.

11. A nitride semiconductor device according to claim 10,  
15 further comprising an adhesion layer comprising a single-layer  
film or a multilayer film, wherein said adhesion layer is  
disposed on the surface of at least one of the first insulating  
layer and the second insulating layer.

20 12. A nitride semiconductor device according to claim 11,  
wherein the upper surface of the adhesion layer contains an  
element of the platinum group.

25 13. A nitride semiconductor device according to claim 11,  
wherein the upper surface of the adhesion layer comprises the

same material as the upper layer of the first electrode.

14. A nitride semiconductor device according to claim 11,  
wherein the upper surface of the adhesion layer comprises Pt.

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15. A nitride semiconductor device according to claim 11,  
wherein the adhesion layer is in contact with one of the upper  
surface and the lower surface of the first electrode.

10        16. A nitride semiconductor device comprising:  
            a semiconductor layer;  
            a first electrode for establishing an ohmic contact disposed  
on the semiconductor layer, the first electrode including an  
upper layer and a lower layer and being subjected to heat  
15        treatment; and

            a second electrode formed on the first electrode, the second  
electrode having a different shape from a shape of the first  
electrode, the second electrode further including an upper layer  
and a lower layer,

20        wherein the upper layer of the first electrode and the lower  
layer of the second electrode comprise the same material and form  
a joint region that joins the first electrode to the second  
electrode.

25        17. A nitride semiconductor device according to claim 16,

wherein the lower layer of the first electrode comprises a material which is alloyable by heat treatment.

18. A nitride semiconductor device according to claim 16,  
5 wherein the upper layer of the first electrode comprises an elemental metal of the platinum group or an alloyed material essentially composed of homologous elements in the platinum group.

19. A nitride semiconductor device according to claim 16,  
10 wherein the lower layer of the second electrode comprises an elemental metal of the platinum group and an alloy including at least one of the platinum group metals.

20. A nitride semiconductor device according to claim 16,  
15 wherein the upper layer of the first electrode comprises Pt.

21. A nitride semiconductor device according to claim 16,  
wherein the lower layer of the second electrode comprises Pt.

20        22. A nitride semiconductor device according to claim 16,  
wherein the surface of the semiconductor layer on which the first electrode is formed comprises an electrode formation region and an insulating layer formation region and the second electrode overlies the electrode formation region and the insulation layer  
25 formation region.

23. A nitride semiconductor device according to claim 22,  
wherein the insulating layer formation region comprises a  
plurality of areas arranged on both sides of the electrode  
5 formation region in a stripe, or a plurality of areas separated  
by the electrode formation region.

24. A nitride semiconductor device according to claim 16,  
wherein the semiconductor layer has a ridge and the first  
10 electrode is disposed on the upper surface of the ridge so that  
the nitride semiconductor device functions as a laser device.

25. A nitride semiconductor device according to claim 24,  
further comprising a first insulating layer extending from the  
15 side surfaces of the ridge to the upper surface of the  
semiconductor layer and a second insulating layer extending from  
the upper surface of the first insulating layer to the side  
surfaces of the semiconductor layer, the second insulating layer  
being separate from the first electrode.

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26. A nitride semiconductor device according to claim 25,  
further comprising an adhesion layer comprising a single-layer  
film or a multilayer film, wherein said adhesion layer is  
disposed on the surface of at least one of the first insulating  
25 layer and the second insulating layer.

27. A nitride semiconductor device according to claim 26,  
wherein the upper surface of the adhesion layer contains an  
element of the platinum group.

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28. A nitride semiconductor device according to claim 26,  
wherein the upper surface of the adhesion layer comprises the  
same material as the upper layer of the first electrode.

10        29. A nitride semiconductor device according to claim 26,  
wherein the upper surface of the adhesion layer comprises Pt.

15        30. A nitride semiconductor device according to claim 26,  
wherein the adhesion layer is in contact with one of the upper  
surface and the lower surface of the first electrode.

31. A nitride semiconductor device comprising:  
a semiconductor layer;  
a first electrode for establishing an ohmic contact disposed  
20 on the semiconductor layer;  
a second electrode on the first electrode, having a  
different shape from the shape of the first electrode; and  
an insulating layer on the surface of the semiconductor  
layer,  
25        wherein the surface of the semiconductor layer on which the

first electrode is formed comprises an electrode formation region and an insulation layer formation region, and the second electrode overlies the electrode formation region and the insulating layer formation region.

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32. A nitride semiconductor device according to claim 31, wherein the insulating layer formation region comprises a plurality of areas arranged on both sides of the electrode formation region in a stripe, or a plurality of areas separated by the electrode formation region.

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33. A nitride semiconductor device according to claim 32, wherein the first electrode is disposed on the upper surface of the ridge so that the nitride semiconductor device functions as a laser device.

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34. A nitride semiconductor device according to claim 33, wherein the insulating layer includes a first insulating sublayer extending from the side surfaces of the ridge to the upper surface of the semiconductor layer and a second insulating sublayer extending from the upper surface of the first insulating sublayer to the side surfaces of the semiconductor layer, the second insulating sublayer being separate from the first electrode.

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35. A nitride semiconductor device according to claim 34,  
further comprising an adhesion layer comprising a single-layer  
film or a multilayer film, wherein the adhesion layer is disposed  
on the surface of at least one of the first insulating sublayer  
5 and the second insulating sublayer.

36. A nitride semiconductor device according to claim 35,  
wherein the upper surface of the adhesion layer contains an  
element of the platinum group.

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37. A nitride semiconductor device according to claim 36,  
wherein the upper surface of the adhesion layer comprises Pt.

38. A nitride semiconductor device according to claim 31,  
15 wherein the semiconductor layer has a ridge and the first  
electrode is disposed on the upper surface of the ridge so that  
the nitride semiconductor device functions as a laser device.

39. A nitride semiconductor device according to claim 38,  
20 wherein the insulating layer includes a first insulating sublayer  
extending from the side surfaces of the ridge to the upper  
surface of the semiconductor layer and a second insulating  
sublayer extending from the upper surface of the first insulating  
sublayer to the side surfaces of the semiconductor layer, the  
25 second insulating sublayer being separate from the first

electrode.

40. A nitride semiconductor device according to claim 39,  
further comprising an adhesion layer comprising a single-layer  
5 film or a multilayer film, wherein the adhesion layer is disposed  
on the surface of at least one of the first insulating sublayer  
and the second insulating sublayer.

41. A nitride semiconductor device according to claim 40,  
10 wherein the upper surface of the adhesion layer contains an  
element of the platinum group.

42. A nitride semiconductor device according to claim 41,  
wherein the upper surface of the adhesion layer comprises Pt.